

WE CLAIM

1. A method for adaptive channel estimation comprising:
 providing a channel estimate;
 determining an at least one channel condition; and
 determining an adapted channel estimate as a function of the
 channel estimate and the channel condition.

- 5 2. The method of claim 1 wherein the channel estimate is a

function of the equation $\mathbf{G}_{u,m} = \mathbf{X}_u^H \mathbf{Y}_m$ and $\mathbf{z}_u(t, f) = \begin{bmatrix} e^{-j(0t-0f)} \\ \vdots \\ e^{-j((K-1)t-0f)} \\ e^{-j(0t-f)} \\ \vdots \\ e^{-j((K-1)t-(B-1)f)} \end{bmatrix}$.

- 10 3. The method of claim 1 wherein the channel estimate is a
 function of the equation $\mathbf{H}_n(k) = \mathbf{Y}(k) / p_1(k)$.

4. The method of claim 1 wherein the channel condition is selected
 from the group comprising multi-path component, direction of arrival,
 dominant time-taps, time of arrival, and Doppler frequencies.

- 15 5. The method of claim 1 wherein the adapted channel estimate is
 a function of the equation:

$$\min_{t_\ell, f_\ell, P_u, \gamma_{m,u}} \sum_{m=1}^M \left| \mathbf{Y}_m - \sum_{u=1}^U \mathbf{X}_u \mathbf{F}_u \gamma_{m,u} \right|^2 + \alpha \sum_{m=1}^M \sum_{u=1}^U \gamma_{m,u}^H \gamma_{m,u}.$$

6. \ The method of claim 1 wherein the channel condition includes a time separation value.

7. The method of claim 1 wherein the adapted channel estimate is
5 a function of the equation:

$$p_n(k) = p_1(k)e^{-j2\pi k(n-1)L_s/K}.$$

8. The method of claim 1 wherein the channel condition includes a TOA estimate.

9. The method of claim 1 wherein the adapted channel estimate is
10 a function of the equation:

$$\nabla t_\ell = \sum_{k=0}^{K-1} \text{Im} \left\{ k e^{j k t_\ell} \boldsymbol{\gamma}_\ell^H \mathbf{H}_n(k) \right\} - \sum_{k=0}^{K-1} \text{Im} \left\{ \sum_{\substack{p=1 \\ p \neq \ell}}^P \boldsymbol{\gamma}_\ell^H \boldsymbol{\gamma}_p k e^{-j k (t_p - t_\ell)} \right\}.$$

10. The method of claim 1 wherein the channel condition includes a time domain channel estimate.

11. The method of claim 1 wherein the adapted channel estimate is
15 a function of the equation:

$$\mathbf{Q}_h = \sigma_h \mathbf{Qd}.$$

12. The method of claim 1 further comprising: replacing the channel estimate with the adapted channel estimate.

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13. The method of claim 1 further comprising:
initializing at least one iteration variable;
calculating an error update as a function of the iteration variable;
- 5 and
determining the adapted channel estimate as a function of the
error update.
14. The method of claim 1 further comprising:
estimating a plurality of TOA values;
separating the TOA values as a function of a time separation
10 value; and
determining the adapted channel estimate as a function of the
separated TOA values.
15. The method of claim 1 further comprising:
estimating a plurality of TOA values;
calculating a TOA gradient as a function of the TOA values; and
determining the adapted channel estimate as a function of the
calculated TOA gradient.
16. The method of claim 1 further comprising:
providing a threshold value;
20 determining a dominant tap value as a function of the threshold
value; and
determining the adapted channel estimate as a function of the
dominant tap value.

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17. A system for adaptive channel estimation comprising:
means for providing a channel estimate;
means for determining an at least one channel condition; and
means for determining an adapted channel estimate as a
function of the channel estimate and the channel condition.
18. The system of claim 17 further comprising means for replacing
the channel estimate with the adapted channel estimate.
19. The system of claim 17 further comprising:
means for initializing at least one iteration variable;
means for calculating an error update as a function of the
iteration variable; and
means for determining the adapted channel estimate as a
function of the error update.
20. The system of claim 17 further comprising:
means for estimating a plurality of TOA values;
means for separating the TOA values as a function of a time
separation value; and
means for determining the adapted channel estimate as a
function of the separated TOA values.

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21. The system of claim 17 further comprising:
means for estimating a plurality of TOA values;
means for calculating a TOA gradient as a function of the TOA
values; and
means for determining the adapted channel estimate as a
function of the calculated TOA gradient.
22. The system of claim 17 further comprising:
means for providing a threshold value;
means for determining a dominant tap value as a function of the
threshold value; and
means for determining the adapted channel estimate as a
function of the dominant tap value.
23. A computer readable medium storing a computer program
comprising:
computer readable code for providing a channel estimate;
computer readable code for determining an at least one channel
condition; and
computer readable code for determining an adapted channel
estimate as a function of the channel estimate and the channel condition.
24. The computer readable medium of claim 23 further comprising
computer readable code for replacing the channel estimate with the adapted
channel estimate.

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25. The computer readable medium of claim 23 further comprising:
computer readable code for initializing at least one iteration
variable;
- 5 computer readable code for calculating an error update as a
function of the iteration variable; and
computer readable code for determining the adapted channel
estimate as a function of the error update.
- 10 26. The computer readable medium of claim 23 further comprising:
computer readable code for estimating a plurality of TOA values;
computer readable code for separating the TOA values as a
function of a time separation value; and
computer readable code for determining the adapted channel
estimate as a function of the separated TOA values.
- 15 27. The computer readable medium of claim 23 further comprising:
computer readable code for estimating a plurality of TOA values;
computer readable code for calculating a TOA gradient as a
function of the TOA values; and
computer readable code for determining the adapted channel
20 estimate as a function of the calculated TOA gradient.
28. The computer readable medium of claim 23 further comprising:
computer readable code for providing a threshold value;
computer readable code for determining a dominant tap value
as a function of the threshold value; and
25 computer readable code for determining the adapted channel
estimate as a function of the dominant tap value.